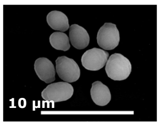
YEAST DERIVATIVES AS NATURAL FEED ADDITIVES

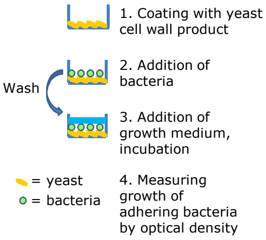
Ilse Dohnal, Anja Ganner, Christian Stoiber, Nicole Reisinger, Jakob Uhlik and Gerd Schatzmayr
BIOMIN Research Center, Tulln, Austria; ilse.dohnal@biomin.net

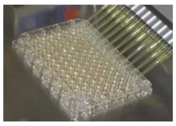


Yeast and its different derivatives have been used as natural feed additives for a long time. Different modes of action contribute to an improvement of animal health and performance. Several examples (pathogen binding, influence on gut morphology, immune modulation and prebiotic effects of yeast in the rumen) will be illustrated by our experimental results.

Pathogen binding capacity of yeast cell wall

The recent development of a quantitative *in vitro* bacterial binding assay for yeast derivatives (Ganner *et al.* 2010) facilitated the optimization of yeast downstream processing to maximize binding capacity for pathogens.





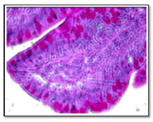
Bound cfu/mg yeast		
	Salmonella enterica	E. coli O8 K87 F4
Yeast autolysate	5x10⁵	9x10³

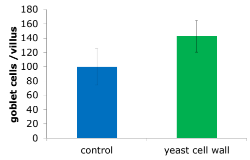
An autolysate of *S. cerevisiae*, enriched in cell wall fragments, improved broiler performance (Reisinger *et al.* 2012). In addition, a statistically significant increase (41%, p = 0.05) in goblet cell density in the jejunum was observed. The mucin produced by goblet cells is an important defense mechanism against invading pathogens.

	Control	Yeast cell wall product (0.1%)
No. animals	208	208
Final weight (g)	1374[a]	1520[b]
Daily weight gain (g)	38.18[a]	42.37[b]
FCR (kg/kg)	2.13	1.92

values in rows with no common superscripts differ significantly ($p \leq 0.05$)

The goblet cells in jejunum tissue were visualized with PAS staining.



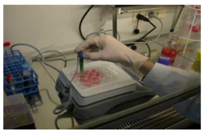


Immunomodulation and influence on barrier function of yeast enriched with nucleotides

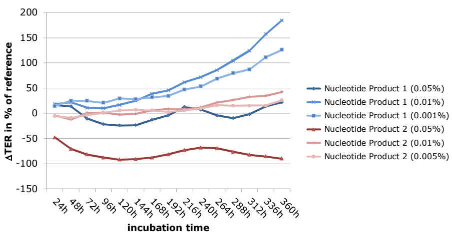
A different, nucleotide enriched yeast derivative also increased broiler performance. *In vitro* experiments suggest possible modes of action: nucleotides lead to an increased transepithelial resistance, supporting a positive influence on gut barrier function.
Moreover, the nitric oxide (NO) production of a murine macrophage cell line in response to a bacterial lipopolysaccharide challenge is decreased, suggesting an anti-inflammatory effect.

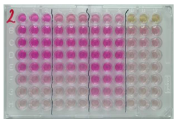
	Control	Nucleotide product (0.02%)	Nucleotide product (0.2%)
No. animals	225	225	225
weight d 0 (g)	41.73	41.78	41.73
weight d 14 (g)	377.19[a]	376.49[a]	392.16[b]
weight d 35 (g)	1819.73	1834.89	1806.12
mortality	1.78	1.33	1.33

values in rows with no common superscripts differ significantly ($p \leq 0.05$)

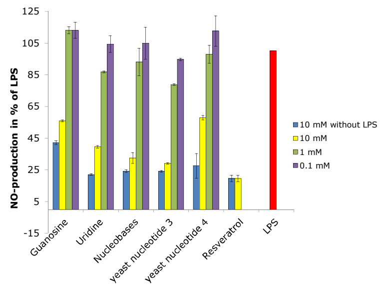


transepithelial resistance (TER) measurement with IPEC-J2 cells



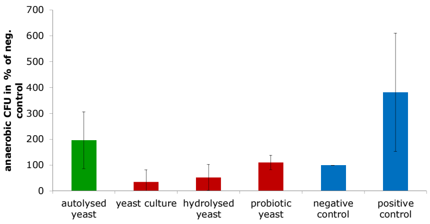


NO production of Raw 264.7 cells incubated for 24h with LPS and nucleotide samples (measured with Griess reagent)

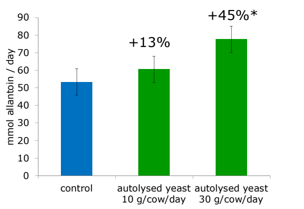


Prebiotic effect of autolysed yeast on rumen microorganisms

A simple *in vitro* rumen fermentation model was employed to compare four different yeast products (autolysed and hydrolyzed yeast, yeast culture and live yeast). The autolysate led to a two-fold increase (albeit not statistically significant) in the number of total anaerobic colony forming units, suggesting a prebiotic effect on rumen microorganisms.



Feeding the autolysate in 35 d periods to nine rumen cannulated heifers in three concentrations in a 3x3 Latin Square design resulted in a dose-dependent, statistically significant increase of urinary allantoin levels. In addition, the rates of *in situ* degradation of Tifton dry matter and neutral detergent fiber were increased.



* statistically significant difference (p=0.04)

Dosage	K_d DM	K_d NDF
0 g autolysed yeast / cow / day	-0.027 / h	-0.029 / h
10 g autolysed yeast / cow / day	-0.032 / h (+18%)	-0.035 / h (+21%)
30 g autolysed yeast / cow / day	-0.036 / h (+33%)	-0.043 / h (+48%)
p value 0 g - 30 g	0.07	0.06

K_d: rate of disappearance, estimated as the slope of the linear regression: ln (% remaining) vs. time

In conclusion, positive effects of different yeast derivatives on monogastric animals as well as on ruminant animals are shown *in vivo* and possible modes of action are suggested by histology as well as *in vitro* experiments.

References:
Ganner A., Stoiber C., Wieder D. and Schatzmayr G. (2010) Journal of Microbiological Methods 83, p168-174
Reisinger N., Ganner A., Masching S., Schatzmayr G. and Applegate T.J. (2012) Livestock Science 143, *2-3*, p195-200